Claims

1. A method of operating a gas turbine power plant comprising of a first gas turbine group (10), consisting of a compressor (12) and a turbine (13) which are connected mechanically with one another, and a second gas turbine group (20), including a combustion device (35), which is placed in the gas flow stream (42, 48) between the first group's (10) compressor (12) and turbine (13), whereby the second gas turbine group (20) consists of a compressor (22), a fuel injection device (51), a combustion chamber (35) and a turbine (22), whereby the second gas turbine group's (20) compressor (22) and turbine (23) are mechanically coupled to one another and at least one of the gas turbine groups (10, 20) having a device for the extraction of useful work (15, 25), **characterised by** the fact that a first flow of water and/or steam is heated with heat from the flue gas from the first group's (10) turbine (13), that further amounts of water and/or steam are heated with heat from a gas stream that is compressed by the first group's (10) compressor (12), and the produced water and/or steam is injected into the gas stream (42, 48) in such amounts that at least 60% of the oxygen content of the air in the stream (42, 48) is consumed through combustion in the combustion device (35), and in that the combustion gas that is fed into the turbine (23) of the second gas turbine group (20) has a pressure in the range 50-300 bar.

2. A method according to claim 1, **characterised** in that said further amount of water is introduced to the gas stream between the first group's (10) compressor (12) and the second gas turbine group's (20) compressor (22).

3. A method according to claim 2, **characterised** in that further amounts of water that entirely or partially has the form of steam optionally is introduced in the gas stream (43, 48) downstream of the second gas turbine group's (20) compressor (22), and in such amounts that at least 60% of the

oxygen content of the air in the stream (42, 48) is consumed through combustion in the combustion device (35).

4. A method according to parts of the claims 1-3, **characterised by** a choice of operational characteristics such that the temperature of the gas flow (48) entering the first gas turbine group's (10) turbine (13) is at most 1200°C, preferably 400-1000°C, and that the pressure is between 5-60 bar.

5. A method according to some of the claims 1-4, **characterised by** a choice of operational characteristics that give a flue gas exit temperature from the first gas turbine group's (10) turbine (13) in the region of 200-500°C.

6. A method according to parts of the claims 1-5, **characterised by** the fact that the first gas turbine group (10) is a gas turbine unit, which is optimised for non-humidified operation, whereby the gas turbine unit can have multiple shafts and possibly include intercooling.

7. A method according to parts of the claims 1-6, **characterised by** the fact that the second gas turbine group's (20) turbine (23) is arranged and operated so that the pressure of the gas stream from the first gas turbine group's (10) compressor (12) and to the first gas turbine group's (10) turbine (13), respectively, is re-allotted such that the first group (10) is well-suited to operate with the media and flow data associated with humidified cycles.

8. A method according to claim 6 or 7, **characterised by** the regulation of the inlet guide vanes of the compressor (12) of the first gas turbine group (10) to reduce the flow of air obtained during operation of the power plant, and that the capacity of the first gas turbine group's (10) compressor (12)

may even be reduced through removing one or more compressor stages.

9. A method according to parts of the claims 1-7, **characterised by** the fact that the first gas turbine group's (10) compressor (12) is complemented with an extraction device (42) used to extract the compressed air, which is sealed against the axle, and the first gas turbine group's (10) turbine (13) is complemented with an injection device (48), which is also sealed against the axle, to return the flue gas to the first gas turbine group's (10) turbine (13).

10. A method according to parts of the claims 1-8, **characterised by** the fact that the exit temperature from the first gas turbine group's (10) compressor (12) is chosen to enable the production of steam of sufficiently high pressure to be used to cool the second gas turbine group's (20) turbine (23) and/or combustion chamber (35).

11. A method according to parts of the claims 1-9, **characterised by** combustion gases, which enter the second gas turbine group´s (20) turbine (13), that have a pressure in the region of 50-300 bar, preferably 60-200 bar, or most desirably 80-150 bar, and a temperature in the region of 1000-2000 K, preferably 1200-1800 K.

12. A method according to parts of the claims 1-11, **characterised by** humidifying the gas exit flow from the second gas turbine group's (20) compressor (22) prior to the second gas turbine group's combustion device (35), preferably by passing at least a part of the said gas flow through a humidifier (87), whose inlet and outlet gas streams are preferably heat exchanged via a recuperator (88), where the inlet water to the humidifier (87) are preferably heated with heat from the gas outlet stream from the first gas turbine group's (10) compressor (12) and/or turbine (13).

13. A method according to parts of the previous claims, **characterised by** using at least a part of the water content of the flue gases to provide the process with feed water and/or steam.

14. A method according to parts of the previous claims, **characterised by** regulating the output of work from the process through changing the amount of water that is transferred to the gas stream, whereby a lower power output is obtained through a lower degree of humidification.

15. A method according to parts of the claims 1-11, **characterised by** the fact that at least a part of the steam used for cooling is introduced thereafter to the gas stream (42,48), preferably in the second gas turbine group's (20) combustion chamber, for further use as the working fluid.

16. A method according to parts of the claims 1-13, **characterised by** the fact that no significant amount of heat is transferred to the gas stream between the second gas turbine group's (20) turbine (23) and the first group's turbine (13).

17. A method according to parts of the previous claims, **characterised by** the fact that the second gas turbine group's (20) compressor is regulated by regulating the lead guide vane or by regulating the axle's rotational speed.

18. A method according to parts of the claims 1-17, **characterised by** the fact that at least 10% of the useful work obtained from the process is extracted via the second gas turbine group's (20) transmission.

19. A method according to any of the claims 1-18, **characterised by** the fact that a heat exchanger through which water flows, is arranged in the hot air flow downstream of the compressor of the first gas turbine group (10), for heating of

the water, which optionally is preheated in an exhaust gas heat exchanger upstream of a flue gas condenser (71) from which the exhaust gas is exhausted from the gas turbine group to the environment, in that the water preferably is produced by the flue gas condenser (71) and in that a part flow of said water, preferably in preheated condition, is heated by a heat exchanger (73), which is passed by flue gas from the turbine (13) of the first gas turbine group (10), and in that the water which is heated by the heat exchangers (74, 73) and which is possibly at least partially is transformed into steam, is fed into the combustion chamber (35), the turbine (23) of the second gas turbine group (20) or the compressed gas flow from the compressor (22) of the second gas turbine group (20), for cooling of the turbine (23) of the second gas turbine group (20).

20. A method according to claim 19, **characterised in** that the water, which is fed into the combustion chamber (35), at least partially has the form of steam.

21. A method according to claim 19 or 20, **characterised by** producing steam by an external boiler (55) and feeding the produced steam into the combustion chamber (35), the turbine (23) of the second gas turbine group (20) or the compressed gas flow from the compressor (22) of the second gas turbine group (20), for cooling of the turbine (23) of the second gas turbine group (20).